



The improvement of diamond-like carbon coatings for tribological and tribo-corrosion applications in automobile engines: an updated review study

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Abstract

Diamond-like carbon (DLC) coatings have gained wide attraction, due to ultra-low coefficient of friction, high resistance to wear, excellent mechanical properties, and inert to chemical substance, especially in the automobile industry in the last decade. However, a lot of research is still carried out to improve the adhesion properties of DLC coatings to metallic substrate to prevent debonding caused mostly by high internal compressive stress and the difference in thermal expansivity between the metallic substrate and the DLC coatings. Consequently, to improve the adhesion of DLC coatings on metallic substrate, the use of interlayers (Si, SiH and Cr, CrN, Ti and TiN) and metallic (Mo, Ti, Cr, and W) and non-metallic (Si, N, and F) doping elements has been put to use. The interlayers form a transition layer between the metallic substrate and the DLC coating, thereby reducing the thermal expansivity between the metallic substrate and the DLC coatings. On the other hand, the metallic and non-metallic doping elements help in reducing the internal compressive stress in the DLC coatings. The present review article focuses mainly on the deposition techniques, characterisation techniques, and improvement of the adhesion properties of DLC coatings on metallic substrates. It showcases Cr-based interlayers and W/WC dopants as an efficient way to improve adhesion properties of DLC coatings for tribological and tribo-corrosion application in the automobile industry.

Keywords Adhesion · Diamond-like carbon (DLC) · Metallic doping · Interlayers · Multilayers